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Study of thermochromic glass performance in the Danish climate and visual comfort perspectives

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Introduction

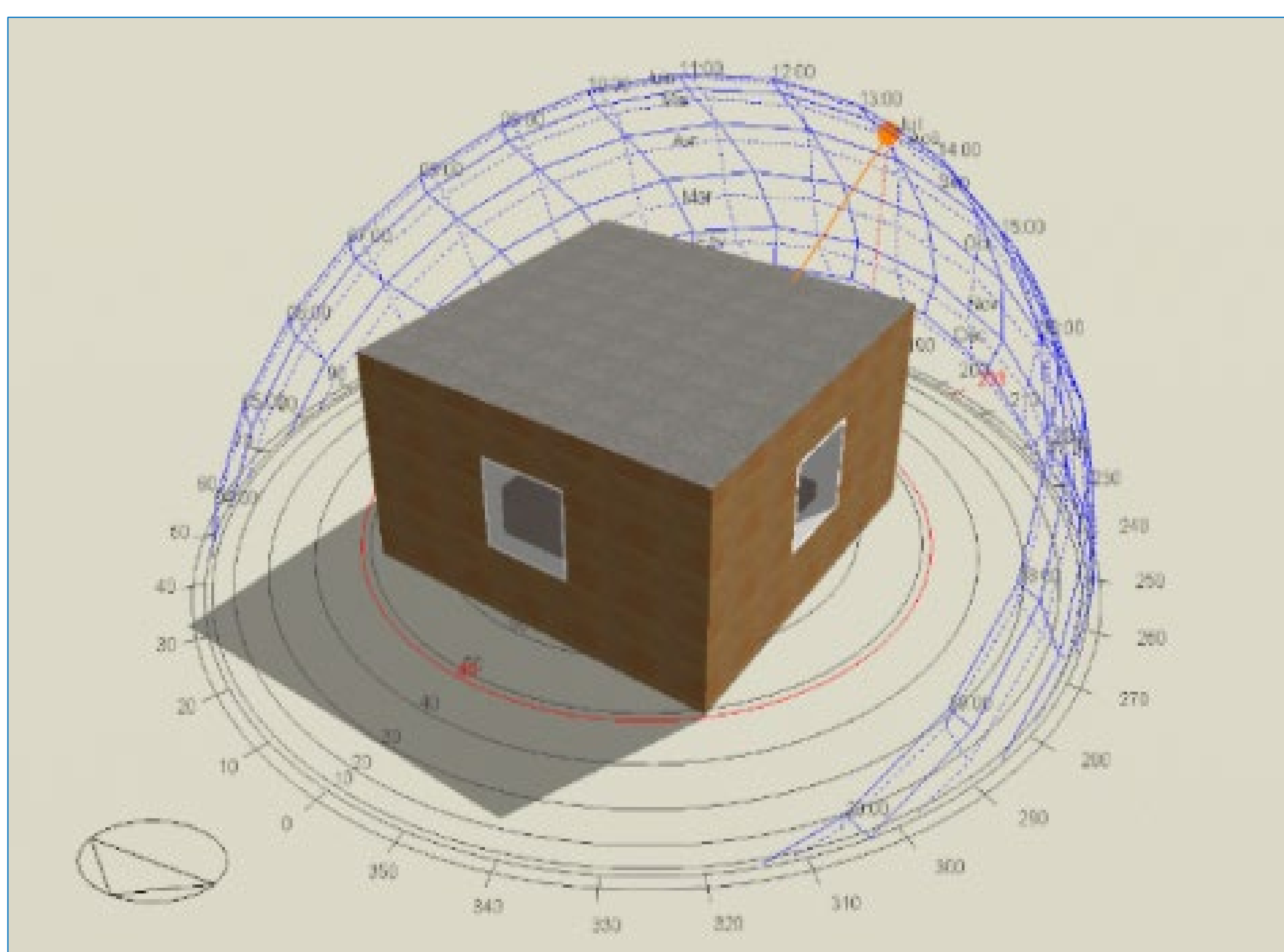
Windows are key elements in the building envelope in terms of energy performance and comfort. Thermochromic materials change their tint, visible-light transmittance and infrared transmittance as a function of temperature. They can be used to form dynamic façade elements for self-regulation of solar gains in order to avoid over-heating inside buildings.

The recent development of these so-called smart thermochromic glazings with the purpose of improving thermal comfort inside buildings raises the question of the visual comfort level offered by such glazings.



Objectives

This numerical study investigates the indoor illuminance comfort level of thermochromic glazing systems under Danish climate conditions.



Methodology

The indoor illuminance comfort level inside a Nordic building is simulated for 5 different commercial thermochromic glazing systems:

- Thermochromic Suntuive® from Pleotint company
- 3 thermochromic glazing systems from Lawrence Berkeley National Laboratory
- Thermochromic Ravenbrick® from RavenWindow company

The numerical study was performed with DesignBuilder (EnergyPlus) Software on a one-room building model.

Glazing system	T_{int} transition state	T_{vis} in clear state
Thermochromic Suntuive®	5 °C to 95 °C	$T_{vis} > 0.6$
Lawrence Berkeley National Laboratory 1	25 °C to 75 °C	$T_{vis} > 0.6$
Lawrence Berkeley National Laboratory 2	25 °C to 75 °C	$T_{vis} \sim 0.55$
Lawrence Berkeley National Laboratory 3	25 °C to 75 °C	$T_{vis} < 0.36$
Thermochromic Ravenbrick®	34 °C to 35 °C	$T_{vis} < 0.36$

Results and conclusions

The thermochromic effect is not activated for a major part of the year because of the cold climate.

Thermochromic systems improve the visual comfort level and reduce glare discomfort by reducing over-lit annual time but increase the demand for artificial lighting.

Wind exposure driving convective heat transfer at the surface of the glazing systems, and sky conditions (cloud cover) have a major impact on the thermochromic glazing's response.

